

## 2.5 Reason Using Properties from Algebra

Let  $a$ ,  $b$ , and  $c$  be real numbers.

### Properties of Equality

Addition Property--If  $a = b$  and  $c = d$ , then  $a + c = b + d$ .

Subtraction Property--If  $a = b$  and  $c = d$ , then  $a - c = b - d$ .

Multiplication Property--If  $a = b$ , then  $ca = cb$ .

Division Property-- If  $a = b$  and  $c \neq 0$ , then  $\frac{a}{c} = \frac{b}{c}$

Distributive Property--  $a(b + c) = ab + ac$

Substitution Property--If  $a = b$ , then either  $a$  or  $b$  may be substituted for the other in any equation.

"Combining like terms"

Reflexive Property--  $a = a$

Symmetric Property--If  $a = b$ , then  $b = a$ .

Transitive Property--If  $a = b$  and  $b = c$ , then  $a = c$ .

Reflexive, symmetric, and transitive also work with congruence.

S.	R.
① $8(x-5) = 32$	① Given
② $8x - 40 = 32$	② Distributive
③ $8x - 40 + 40 = 32 + 40$	③ Addition
④ $8x = 72$	④ Subst.
⑤ $\frac{8x}{8} = \frac{72}{8}$	⑤ Division
⑥ $x = 9$	⑥ Subst.

G:  $8(x-5) = 32$   
P:  $x = 9$

Example 1

1.  $8(x - 5) = 321$ .

2.  $8x - 40 = 322$ .

3.  $8x = 723$ .

4.  $x = 94$ .

Example 2	Stmnt	Reasons
1.	$5x - 3 = 12$	1. Given
2.	$5x = 15$	2. Addition
3.	$x = 3$	3. Division

Example 3	
1. $8x + 3x - 9 = 24$	1. Given
2. $11x - 9 = 24$	2. Subst
3. $11x = 33$	3. Add
4. $x = 3$	4. Div.

Example 4

1.	$2(5 - 3x) - 4(x + 7) = 92$	1. Given
2.	$10 - 6x - 4x - 28 = 92$	2. Distr.
3.	$-10x - 18 = 92$	3. Subst
4.	$-10x = 110$	4. Add
5.	$x = -11$	5. Div.
6.	$-11 = x$	6. Symm.

Justify each statement.

- Reflexive  $m\angle 1 = m\angle 1$
- Addition If  $m\angle 1 = m\angle 2$ , then  $m\angle 1 + m\angle 3 = m\angle 2 + m\angle 3$
- Mult. If  $AB = CD$ , then  $2 \cdot AB = 2 \cdot CD$ .
- Symmetric If  $RS = XY$ , then  $XY = RS$
- Transitive If  $m\angle A = m\angle B$ , and  $m\angle B = m\angle C$ , then  $m\angle A = m\angle C$ .
- Division If  $2 \cdot m\angle 1 = 90$ , then  $m\angle 1 = 45$
- Subst. If  $m\angle 9 + m\angle 10 = 150^\circ$ , and the  $m\angle 10 = 48^\circ$ , then  $m\angle 9 + 48 = 150$ .
- Subst. If  $m\angle 9 + 48 = 150$ , then  $m\angle 9 = 102$ .

State the property that justifies each statement.

4. If  $2x = 5$ , then  $x = \frac{5}{2}$

5. If  $\frac{x}{2} = 7$ , then  $x = 14$ .

6. If  $x = 5$  and  $b = 5$ , then  $x = b$ .

7. If  $XY - AB = WZ - AB$ , then  $XY = WZ$ .

8. Solve  $\frac{x}{2} + 4x - 7 = 11$ . List the property that justifies each step.

9. Complete the following proof.

Given:  $5 - \frac{2}{3}x = 1$

Prove:  $x = 6$

Proof:

Statements	Reasons
a. <u>?</u>	a. Given
b. $3(5 - \frac{2}{3}x) = 3(1)$	b. <u>?</u>
c. $15 - 2x = 3$	c. <u>?</u>
d. <u>?</u>	d. Subtraction Prop.
e. $x = 6$	e. <u>?</u>

Hw  
p108-109  
3-7, 9, 21-25,